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AUTHOR Greenberg, Gilda M.  
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## ABSTRACT

The merits of a six-week workshop for women offered at Western Michigan University and aimed at exploring new perspectives in careers and at increasing self-confidence in mathematical skills considered appropriate for careers in science and technology are examined. Twenty students enrolled in the workshop. The content of each of the six sessions is outlined and the evaluation method is described. Results of the evaluation showed that: eight of the 20 women reported significant changes in educational and future planning; the remaining 12 students were encouraged to re-examine plans; and the use of "peer-to-peer" teaching-tutoring proved to be very important. The appendices contain an outline of the workshop program and a workshop reaction sheet.  
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Enlarging the Career Aspirations  
of Women Students by Alleviating  
Math and Science Anxiety

Prepared by

Gilda M. Greenberg  
Associate Professor of Humanities and Social Science  
College of General Studies  
Western Michigan University, Kalamazoo, Michigan

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ENLARGING THE CAREER ASPIRATIONS  
OF WOMEN STUDENTS BY ALLEVIATING  
MATH AND SCIENCE ANXIETY

Gilda M. Greenberg  
Associate Professor of Humanities and Social Science  
College of General Studies  
Western Michigan University

Introduction

This paper will attempt to explore the merits of a six-week workshop which ran concurrently with a course in humanities (Women: Past, Present and Future) in the College of General Studies at Western Michigan University.

The primary motives for initiating this project were based upon the following factors.

a) The participation of women in the scientific and technological fields has been disproportionately low compared to other professional areas of concentration.

b) Many studies reviewed by Ernest (1976) have strengthened the conclusions of researchers like Sells (1973) that mathematics as a "critical filter" tends to eliminate women from many professional opportunities involving skills in mathematics and science.

c) The descriptive materials of the Wellesley and Wesleyan programs by Tobias (1976-77) demonstrating the successful outcomes from experimental courses, clinics, counseling and tutorial services in alleviating math anxiety stimulated further study.

d) The availability of statistics from the Office of Institutional Research at Western Michigan University, showing the lack of enrollment by women in areas such as engineering, mathematics, science, etc. with a predominance of participation in the selection of majors in traditional career patterns.

### Survey

All of these four factors contributed to the survey of students in two sections of Women: Past, Present and Future at the beginning of the Fall semester of 1977. Questions were designed to obtain information pertaining to attitudes and experiences in math and science.

A brief analysis of statements by 48 students showed that 22 had negative feelings about mathematics, 20 had positive experiences and 6 had both positive and negative attitudes. The major conclusion by the women however, was that there was no need or interest in obtaining additional math skills since the selection of individual career ladders did not require the advanced work in this subject.

Another section of the survey asked students if they would be willing to participate in a six-week workshop which would explore new perspectives in careers and simultaneously increase self-confidence in mathematical skills considered appropriate for careers in science and technology. The positive response and enthusiasm by 30 of the 48 students was unexpected. The need was apparently there and the process for meeting these needs had to be considered.

### Procedure

It is essential to note that this project was encouraged by both administrators and colleagues of Western Michigan University. However, the time and effort required for implementing and coordinating the workshop was in addition to the writer's normal workload. Before proceeding further, the next phase in planning was to consider three questions.

1. How can the interest level of participants be maintained for a period of six-weeks - (Two hours additional per week) when no credit is accompanied at the completion of the session?

2. What format would be appropriate and effective for a short period of time?

3. What type of assistance is necessary to fulfill the proposed objectives?

a) To develop positive math experiences for the participants of the project (e.g. exercises in basic math, metrics, graphing, computer science, and statistics).

b) To invite successful role models from several non-traditional occupations who will provide information demonstrating the relevance of math and science in their individual careers.

c) To provide psychological counseling and an atmosphere for increasing the self-confidence of each participant.

To respond to number one, we had enough women who were highly motivated to consider this question partially solved. Since this workshop was also an experimental part of the humanities course on women, an additional incentive was suggested. Students who opted to attend the workshop for the complete six weeks were able to use that experience with its assignments, evaluation sheets, written critiques, etc. as fulfilling one of the requirements of the course. This was a very satisfactory method since it produced perfect attendance for the entire period of the seminars.

Question two was answered during the planning phase with the assistance of three women who are seniors at this school. The idea was to provide a format in a non-threatening atmosphere in which women could strengthen and improve their concept of self as well as their abilities in the basic math and science. Tutorial service was considered an important adjunct to the format of the project. Our aim was to provide enough stimulation, encouragement, and basic skills to motivate the women to consider a revision in their future educational and vocational planning.

Question three is important when one has limited facilities, personnel and funding. In light of many rational reasons why something should not be attempted, the following might be of value.

After realizing that students were stimulated towards an activity related to their needs, the idea of this project was presented to the Office of Instructional Development for funding. Through limited financial support, student assistant awards were given to three dynamic women who are seniors at the University. Their major areas included mathematics, biology, chemistry, and computer science. We were also given a small amount of money for materials, films, duplication services, etc. A brief outline of the fall project is presented in Appendix A.

#### Subjects

Due to timing, physical space, and schedules, 20 of 30 students committed themselves to the entire six weeks. A brief summary of our group follows:

| <u>Age</u> |   | <u>Major Areas</u> |   |
|------------|---|--------------------|---|
| -19        | 5 | Art                | 2 |
| 20-24      | 8 | Liberal Arts       | 4 |
| 25-29      | 2 | Bus. Admin.        | 3 |
| 30-34      | 2 | Education          | 1 |
| 35-39      | 2 | Health Science     | 3 |
| 40-44      | 1 | Merchandising      | 1 |
|            |   | Physical Ed.       | 1 |
|            |   | Social Work        | 3 |
|            |   | Sociology          | 1 |
|            |   | Speech Pathology   | 1 |

#### Method

Session one and two consisted of informal discussions, basic skill exercises, and a role model from the field of science and math.

Session three was designed to bring three successful women to the group for an analysis of their individual experiences, job opportunities, and future expectations.

Session four developed into a special "hands-on" experience in the computer center of the university. The guest lecturer, an administrator in the College of Applied Science, has been involved in computer technology for many years and shared her expertise with the participants.

Session five was planned to introduce basic statistical concepts. In addition, a demonstration of graphing and a short film was presented.

Session six was composed of a review of concepts considered in the five preceding sessions. The assessment of the total program concluded the final session.

#### Evaluation and Outcomes

A weekly reaction sheet (Appendix B) was used to assess the learning process as well as the attitudes of the women. The three student assistants and the writer discussed the outcomes of each weekly session and whenever possible, revised programming based upon student reactions and our own observations.

The informal statements of many of the women during the periods of self-assessment, demonstrated the importance of a format which is non-threatening. This is essential in order for women to overcome the insecurities and anxieties that have existed for many years. Tutorial service was available on an informal basis. The willingness of the student assistants to serve the other women made this a strong feature of the program.

At the final session we requested an evaluation of the six-week workshop to determine the usefulness of this project and the probability for continuation with other women students.

The overwhelming positive evaluation confirmed the hypothesis, by the writer, that the relationship of trust between students and the

coordinator-instructor in the humanities course sessions, would be a significant factor in the success of the six-week workshop. The ease with which the non-threatening atmosphere was transferred from the class experience to the workshop experience is an important consideration for anyone attempting this type of project.

### Final Evaluation Results

#### Questions

Total responses (100%) = 20

1. If you had an opportunity now or in the near future would you consider taking a course in:

|            |               |             |                    |
|------------|---------------|-------------|--------------------|
| a) math    | Yes <u>16</u> | No <u>0</u> | Undecided <u>5</u> |
| b) science | Yes <u>11</u> | No <u>1</u> | Undecided <u>8</u> |

2. Do you think this workshop has been of value to you.

Yes 20 No 0

3. Would you recommend the continuation of the mini-workshop for other students?

Yes 20 No 0

4. Have you revised any of your career and educational plans due to these sessions?

Yes 8 No 12

5. This question gave students the opportunity to make additional comments and suggest improvements. Some of the interesting ideas expressed were:

"This class also encouraged me to encourage my daughters, at a very early age, to begin thinking about careers in the math or scientific disciplines--areas which were closed to me as a girl growing up in the fifties."

"The workshop opened my eyes to the many opportunities in jobs for women beside the usual stuff. Also, I learned how important it is to have an idea of math just for your own peace of mind."

"Before these sessions I was extremely apprehensive in the math/science area. But after these sessions, I realize my skills were really quite good. I just needed brushing up on them! I'm not as ignorant as I thought!"

"I was motivated to take an Algebra class (my first math since 9th grade)."

"I've always wanted to check into certain fields of math but was always discouraged. From these sessions my confidence has been built up and I now will look into a career dealing with math."

"I wanted you to know what this class has done for me. I have opened my eyes to many things that I've never seen before. Most of all I've learned about myself - who I am and where I'm going. After participating in the workshop, I decided to take a math course this winter. I'm actually looking forward to it."

"The student assistants taught the skill areas in a way that it was easier to understand. The fact that our group was all female provided a non-threatening atmosphere for learning."

The above comments were a few samples of the many that were recorded regarding this experience. They provide the means for careful analysis and major breakthrough in creating a worthwhile learning experience in both personal introspection and cognitive learning.

#### Conclusion

If a short six-week workshop can provide an approach to enhance student self-confidence in areas of math and science, then perhaps the model should be replicated by more instructors involved in women's studies courses. Eight students out of 20 reported significant changes in educational and future planning. The others were encouraged to re-examine plans, but more interestingly, became committed to assist other women in career exploration of non-traditional professions.

The continued use of "peer-to-peer" teaching-tutoring is an important highlight reflected in the final assessment. The emotional security of working with one's peers in a non-threatening environment needs to be included in any program where anxiety is a block to learning and risk-taking.

The implications of such an effort are quite clear. The number of women who would pursue careers that require math and science skills would be increased to the point that we would no longer be compelled to say that a specific subject deprives women from entering all professions.

This will have the effect we are striving for today--overcoming the "hidden agenda" in achieving the spirit of affirmative action.

It is now anticipated that due to this pilot project, the administration may consider the advantages of continuing this model as an integral part of women's studies courses.

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Ernest, John Mathematics and Sex. Mathematics Dept, University of California, Santa Barbara, April 1976

Sells, Lucy W. H.S. Mathematics as the Critical Filter in the Job Market. Proceedings of the Conference on Minority Graduate Education at the University of California, Berkeley, May 1973. pp. 47-49

Tobias, Sheila - Packet of materials Wellesley - Wesleyan Math Project (1976-1977) Wesleyan University, Middletown, Conn. 06457 (cost \$4.00)

Note: Additional materials used in the workshop will be shared with those who request them from Dr. Gilda M. Greenberg, Associate Professor of Humanities and Social Science, Western Michigan University, 209 Moore Hall, Kalamazoo, Michigan 49008

The writer is grateful to Paula Berlin, Olga Brezden, and Molly Julian. The enthusiasm and intellectual contributions of these fine student assistants contributed to whatever favorable outcomes were derived from this experiment.

Appendix A

SCHEDULE FOR GHUM 411 PROJECT  
ENLARGING THE CAREER ASPIRATIONS OF WOMEN STUDENTS  
BY ALLEVIATING MATH & SCIENCE ANXIETY

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First Session

- a) Discussion of approaches to seminars
- b) Responsibility of participants
- c) Basic review of math skills
- d) Sentence completion

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Second Session

Use of metrics and application to work  
and life.  
Role Model

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Third Session

Panel discussion with three successful  
career women in different fields.  
(To be arranged)  
a) Examination of job opportunities for  
women today and in the future

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Fourth Session

Use of computer science and its importance  
to women in all careers.  
Presenter: Computer Science Specialist  
Role Model

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Fifth Session

Film: Graphing  
Introduction to Statistics  
Role Model

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Sixth Session

Summary, Review, Analysis  
Career Exploration - What Now?  
Assessment

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Sessions 1, 4, 5, and 6 were carefully planned and implemented by the  
three student assistants.

Appendix B

Special Workshop  
GHUM 411 - Women: Past, present and future

Dr. Gilda M. Greenberg

Workshop Reaction Sheet

Date \_\_\_\_\_, 1977

Your frank and thoughtful reactions to the presentation just demonstrated should be helpful in evaluating what we have done and in planning for the future.

Circle the appropriate numbers. #1 is low; #5 is high.

My general reaction to this session is: 1 2 3 4 5

My interest in today's topic is: 1 2 3 4 5

The amount of my personal learning in today's session: 1 2 3 3 5

High spots of the presentation were:

1.

2.

3.

Suggestions for improvement.